

29

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<110> Crowl, Robert M.  
Luk, Daniel C.

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Trp	Val	Leu	Pro	Asp	Gly	Ser	Ile	Leu	Lys	Ala	Pro	Met	Asp	Asp	Pro														
															515				520				525						
Asp	Ser	Lys	Phe	Ser	Ile	Leu	Ser	Ser	Gly	Trp	Leu	Arg	Ile	Lys															

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	

Glu	Ser	Val	Thr	Leu	Pro	Cys	Asn	Ala	Leu	Ala	Ile	Pro	Glu	Ala	His
		595					600					605			
Leu	Ser	Trp	Ile	Leu	Pro	Asn	Arg	Arg	Ile	Ile	Asn	Asp	Leu	Ala	Asn
	610					615					620				
Thr	Ser	His	Val	Tyr	Met	Leu	Pro	Asn	Gly	Thr	Leu	Ser	Ile	Pro	Lys
625					630					635					640
Val	Gln	Val	Ser	Asp	Ser	Gly	Tyr	Tyr	Arg	Cys	Val	Ala	Val	Asn	Gln
				645					650					655	
Gln	Gly	Ala	Asp	His	Phe	Thr	Val	Gly	Ile	Thr	Val	Thr	Lys	Lys	Gly
			660					665					670		
Ser	Gly	Leu	Pro	Ser	Lys	Arg	Gly	Arg	Arg	Pro	Gly	Ala	Lys	Ala	Leu
		675					680					685			
Ser	Arg	Val	Arg	Glu	Asp	Ile	Val	Glu	Asp	Glu	Gly	Gly	Ser	Gly	Met
	690					695					700				
Gly	Asp	Glu	Glu	Asn	Thr	Ser	Arg	Arg	Leu	Leu	His	Pro	Lys	Asp	Gln
705					710					715					720
Glu	Val	Phe	Leu	Lys	Thr	Lys	Asp	Asp	Ala	Ile	Asn	Gly	Asp	Lys	Lys
				725					730					735	
Ala	Lys	Lys	Gly	Arg	Arg	Lys	Leu	Lys	Leu	Trp	Lys	His	Ser	Glu	Lys
			740					745					750		
Glu	Pro	Glu	Thr	Asn	Val	Ala	Glu	Gly	Arg	Arg	Val	Phe	Glu	Ser	Arg
		755					760					765			
Arg	Arg	Ile	Asn	Met	Ala	Asn	Lys	Gln	Ile	Asn	Pro	Glu	Arg	Trp	Ala
	770					775					780				
Asp	Ile	Leu	Ala	Lys	Val	Arg	Gly	Lys	Asn	Leu	Pro	Lys	Gly	Thr	Glu
785					790					795					800
Val	Pro	Pro	Leu	Ile	Lys	Thr	Thr	Ser	Pro	Pro	Ser	Leu	Ser	Leu	Glu
				805					810					815	
Val	Thr	Pro	Pro	Phe	Pro	Ala	Val	Ser	Pro	Pro	Ser	Ala	Ser	Pro	Val
			820					825					830		
Gln	Thr	Val	Thr	Ser	Ala	Glu	Glu	Ser	Ser	Ala	Asp	Val	Pro	Leu	Leu
		835					840					845			
Gly	Glu	Glu	Glu	His	Val	Leu	Gly	Thr	Ile	Ser	Ser	Ala	Ser	Met	Gly
	850					855					860				
Leu	Glu	His	Asn	His	Asn	Gly	Val	Ile	Leu	Val	Glu	Pro	Glu	Val	Thr
865					870					875					880
Ser	Thr	Pro	Leu	Glu	Glu	Val	Val	Asp	Asp	Leu	Ser	Glu	Lys	Thr	Glu
				885					890					895	
Glu	Ile	Thr	Ser	Thr	Glu	Gly	Asp	Leu	Lys	Gly	Thr	Ala	Ala	Pro	Thr
			900					905					910		
Leu	Ile	Ser	Glu	Pro	Tyr	Glu	Pro	Ser	Pro	Thr	Leu	His	Thr	Leu	Asp
		915					920					925			
Thr	Val	Tyr	Glu	Lys	Pro	Thr	His	Glu	Glu	Thr	Ala	Thr	Glu	Gly	Trp
	930					935					940				
Ser	Ala	Ala	Asp												

# THESE

1010				1015				1020							
Glu	Pro	Gly	Val	Pro	Gly	Gln	Ser	His	Leu	Gln	Gly	Leu	Thr	Asp	Asn
1025					1030					1035					1040
Ile	His	Leu	Val	Lys	Ser	Ser	Leu	Ser	Thr	Gln	Asp	Thr	Leu	Leu	Ile
				1045					1050					1055	
Lys	Lys	Gly	Met	Lys	Glu	Met	Ser	Gln	Thr	Leu	Gln	Gly	Gly	Asn	Met
			1060					1065					1070		
Leu	Glu	Gly	Asp	Pro	Thr	His	Ser	Arg	Ser	Ser	Glu	Ser	Glu	Gly	Gln
		1075					1080				1085				
Glu	Ser	Lys	Ser	Ile	Thr	Leu	Pro	Asp	Ser	Thr	Leu	Gly	Ile	Met	Ser
	1090					1095					1100				
Ser	Met	Ser	Pro	Val	Lys	Lys	Pro	Ala	Glu	Thr	Thr	Val	Gly	Thr	Leu
1105					1110					1115					1120
Leu	Asp	Lys	Asp	Thr	Thr	Thr	Val	Thr	Thr	Thr	Pro	Arg	Gln	Lys	Val
				1125				1130						1135	
Ala	Pro	Ser	Ser	Thr	Met	Ser	Thr	His	Pro	Ser	Arg	Arg	Arg	Pro	Asn
			1140					1145					1150		
Gly	Arg	Arg	Arg	Leu	Arg	Pro	Asn	Lys	Phe	Arg	His	Arg	His	Lys	Gln
	1155					1160					1165				
Thr	Pro	Pro	Thr	Thr	Phe	Ala	Pro	Ser	Glu	Thr	Phe	Ser	Thr	Gln	Pro
	1170					1175				1180					
Thr	Gln	Ala	Pro	Asp	Ile	Lys	Ile	Ser	Ser	Gln	Val	Glu	Ser	Ser	Leu
1185					1190					1195					1200
Val	Pro	Thr	Ala	Trp	Val	Asp	Asn	Thr	Val	Asn	Thr	Pro	Lys	Gln	Leu
			1205					1210						1215	
Glu	Met	Glu	Lys	Asn	Ala	Glu	Pro	Thr	Ser	Lys	Gly	Thr	Pro	Arg	Arg
			1220					1225					1230		
Lys	His	Gly	Lys	Arg	Pro	Asn	Lys	His	Arg	Tyr	Thr	Pro	Ser	Thr	Val
	1235					1240				1245					
Ser	Ser	Arg	Ala	Ser	Gly	Ser	Lys	Pro	Ser	Pro	Ser	Pro	Glu	Asn	Lys
	1250					1255				1260					
His	Arg	Asn	Ile	Val	Thr	Pro	Ser	Ser	Glu	Thr	Ile	Leu	Leu	Pro	Arg
1265					1270					1275					1280
Thr	Val	Ser	Leu	Lys	Thr	Glu	Gly	Pro	Tyr	Asp	Ser	Leu	Asp	Tyr	Met
			1285					1290						1295	
Thr	Thr	Thr	Arg	Lys	Ile	Tyr	Ser	Ser	Tyr	Pro	Lys	Val	Gln	Glu	Thr
			1300					1305					1310		
Leu	Pro	Val	Thr	Tyr	Lys	Pro	Thr	Ser	Asp	Gly	Lys	Glu	Ile	Lys	Asp
	1315					1320					1325				
Asp	Val	Ala	Thr	Asn	Val	Asp	Lys	His	Lys	Ser	Asp	Ile	Leu	Val	Thr
	1330					1335				1340					
Gly	Glu	Ser													

[illegible]

Thr	Thr	Leu	Ser	Ile	Lys	Val	Glu	Val	Ala	Ser	Ser	Gln	Ala	Glu	
				1445				1450						1455	
Thr	Thr	Thr	Leu	Asp	Gln	Asp	His	Leu	Glu	Thr	Thr	Val	Ala	Ile	Leu
			1460					1465					1470		
Leu	Ser	Glu	Thr	Arg	Pro	Gln	Asn	His	Thr	Pro	Thr	Ala	Ala	Arg	Met
		1475					1480					1485			
Lys	Glu	Pro	Ala	Ser	Ser	Ser	Pro	Ser	Thr	Ile	Leu	Met	Ser	Leu	Gly
	1490					1495					1500				
Gln	Thr	Thr	Thr	Thr	Lys	Pro	Ala	Leu	Pro	Ser	Pro	Arg	Ile	Ser	Gln
1505					1510					1515					1520
Ala	Ser	Arg	Asp	Ser	Lys	Glu	Asn	Val	Phe	Leu	Asn	Tyr	Val	Gly	Asn
			1525					1530						1535	
Pro	Glu	Thr	Glu	Ala	Thr	Pro	Val	Asn	Asn	Glu	Gly	Thr	Gln	His	Met
		1540					1545					1550			
Ser	Gly	Pro	Asn	Glu	Leu	Ser	Thr	Pro	Ser	Ser	Asp	Arg	Asp	Ala	Phe
	1555					1560					1565				
Asn	Leu	Ser	Thr	Lys	Leu	Glu	Leu	Glu	Lys	Gln	Val	Phe	Gly	Ser	Arg
	1570					1575				1580					
Ser	Leu	Pro	Arg	Gly	Pro	Asp	Ser	Gln	Arg	Gln	Asp	Gly	Arg	Val	His
1585					1590				1595						1600
Ala	Ser	His	Gln	Leu	Thr	Arg	Val	Pro	Ala	Lys	Pro	Ile	Leu	Pro	Thr
			1605					1610						1615	
Ala	Thr	Val	Arg	Leu	Pro	Glu	Met	Ser	Thr	Gln	Ser	Ala	Ser	Arg	Tyr
		1620					1625					1630			
Phe	Val	Thr	Ser	Gln	Ser	Pro	Arg	His	Trp	Thr	Asn	Lys	Pro	Glu	Ile
	1635					1640					1645				
Thr	Thr	Tyr	Pro	Ser	Gly	Ala	Leu	Pro	Glu	Asn	Lys	Gln	Phe	Thr	Thr
	1650				1655					1660					
Pro	Arg	Leu	Ser	Ser	Thr	Thr	Ile	Pro	Leu	Pro	Leu	His	Met	Ser	Lys
1665				1670				1675							1680
Pro	Ser	Ile	Pro	Ser	Lys	Phe	Thr	Asp	Arg	Arg	Thr	Asp	Gln	Phe	Asn
		1685					1690						1695		
Gly	Tyr	Ser	Lys	Val	Phe	Gly	Asn	Asn	Asn	Ile	Pro	Glu	Ala	Arg	Asn
		1700					1705					1710			
Pro	Val	Gly	Lys	Pro	Pro	Ser	Pro	Arg	Ile	Pro	His	Tyr	Ser	Asn	Gly
	1715					1720				1725					
Arg	Leu	Pro	Phe	Phe	Thr	Asn	Lys	Thr	Leu	Ser	Phe	Pro	Gln	Leu	Gly
	1730				1735				1740						
Val	Thr	Arg	Arg	Pro	Gln	Ile	Pro	Thr	Ser	Pro	Ala	Pro	Val	Met	Arg
1745				1750				1755							1760
Glu	Arg	Lys	Val	Ile	Pro	Gly	Ser	Tyr	Asn	Arg	Ile	His	Ser	His	Ser
		1765					1770						1775		
Thr	Phe	His	Leu	Asp	Phe	Gly	Pro	Pro	Ala	Pro	Pro	Leu	Leu	His	Thr
		1780					1785								



1860	1865	1870
Phe Pro Cys Glu Ala Thr Gly Lys	Pro Lys Pro Phe Val Thr Trp Thr	
1875	1880	1885
Lys Val Ser Thr Gly Ala Leu Met Thr	Pro Asn Thr Arg Ile Gln Arg	
1890	1895	1900
Phe Glu Val Leu Lys Asn Gly Thr Leu Val	Ile Arg Lys Val Gln Val	
1905	1910	1915
Gln Asp Arg Gly Gln Tyr Met Cys Thr Ala	Ser Asn Leu His Gly Leu	1920
1925	1930	1935
Asp Arg Met Val Val Leu Leu Ser Val Thr	Val Gln Gln Pro Gln Ile	
1940	1945	1950
Leu Ala Ser His Tyr Gln Asp Val Thr Val	Tyr Leu Gly Asp Thr Ile	
1955	1960	1965
Ala Met Glu Cys Leu Ala Lys Gly Thr Pro	Ala Pro Gln Ile Ser Trp	
1970	1975	1980
Ile Phe Pro Asp Arg Arg Val Trp Gln Thr	Val Ser Pro Val Glu Ser	
1985	1990	1995
Arg Ile Thr Leu His Glu Asn Arg Thr Leu	Ser Ile Lys Glu Ala Ser	2000
2005	2010	2015
Phe Ser Asp Arg Gly Val Tyr Lys Cys Val	Ala Ser Asn Ala Ala Gly	
2020	2025	2030
Ala Asp Ser Leu Ala Ile Arg Leu His Val	Ala Ala Leu Pro Pro Val	
2035	2040	2045
Ile His Gln Glu Lys Leu Glu Asn Ile Ser	Leu Pro Pro Gly Leu Ser	
2050	2055	2060
Ile His Ile His Cys Thr Ala Lys Ala Ala	Pro Leu Pro Ser Val Arg	
2065	2070	2075
Trp Val Leu Gly Asp Gly Thr Gln Ile Arg	Pro Ser Gln Phe Leu His	2080
2085	2090	2095
Gly Asn Leu Phe Val Phe Pro Asn Gly Thr	Leu Tyr Ile Arg Asn Leu	
2100	2105	2110
Ala Pro Lys Asp Ser Gly Arg Tyr Glu Cys	Val Ala Ala Asn Leu Val	
2115	2120	2125
Gly Ser Ala Arg Arg Thr Val Gln Leu Asn	Val Gln Arg Ala Ala Ala	
2130	2135	2140
Asn Ala Arg Ile Thr Gly Thr Ser Pro Arg	Arg Thr Asp Val Arg Tyr	
2145	2150	2155
Gly Gly Thr Leu Lys Leu Asp Cys Ser Ala	Ser Gly Asp Pro Trp Pro	
2165	2170	2175
Arg Ile Leu Trp Arg Leu Pro Ser Lys Arg	Met Ile Asp Ala Leu Phe	
2180	2185	2190
Ser Phe Asp Ser Arg Ile Lys Val Phe Ala	Asn Gly Thr Leu Val Val	
2195	2200	2205
Lys Ser Val Thr Asp Lys Asp Ala Gly Asp	Tyr Leu Cys Val Ala Arg	
2210	2215	2220
Asn Lys Val Gly Asp Asp Tyr Val Val Leu	Lys Val Asp Val Val Met	
2225	2230	2235
Lys Pro Ala Lys Ile Glu His Lys Glu Glu	Asn Asp His Lys Val Phe	
2245	2250	2255
Tyr Gly Gly Asp Leu Lys Val Asp Cys Val	Ala Thr Gly Leu Pro Asn	
2260	2265	2270
Pro Glu Ile Ser Trp Ser Leu Pro Asp Gly	Ser Leu Val Asn Ser Phe	
2275	2280	2285

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Met	Gln	Ser	Asp	Asp	Ser	Gly	Gly	Arg	Thr	Lys	Arg	Tyr	Val	Val	Phe	2290	2295	2300	
Asn	Asn	Gly	Thr	Leu	Tyr	Phe	Asn	Glu	Val	Gly	Met	Arg	Glu	Glu	Gly	2305	2310	2315	2320
Asp	Tyr	Thr	Cys	Phe	Ala	Glu	Asn	Gln	Val	Gly	Lys	Asp	Glu	Met	Arg	2325	2330	2335	
Val	Arg	Val	Lys	Val	Val	Thr	Ala	Pro	Ala	Thr	Ile	Arg	Asn	Lys	Thr	2340	2345	2350	
Tyr	Leu	Ala	Val	Gln	Val	Pro	Tyr	Gly	Asp	Val	Val	Thr	Val	Ala	Cys	2355	2360	2365	
Glu	Ala	Lys	Gly	Glu	Pro	Met	Pro	Lys	Val	Thr	Trp	Leu	Ser	Pro	Thr	2370	2375	2380	
Asn	Lys	Val	Ile	Pro	Thr	Ser	Ser	Glu	Lys	Tyr	Gln	Ile	Tyr	Gln	Asp	2385	2390	2395	2400
Gly	Thr	Leu	Leu	Ile	Gln	Lys	Ala	Gln	Arg	Ser	Asp	Ser	Gly	Asn	Tyr	2405	2410	2415	
Thr	Cys	Leu	Val	Arg	Asn	Ser	Ala	Gly	Glu	Asp	Arg	Lys	Thr	Val	Trp	2420	2425	2430	
Ile	His	Val	Asn	Val	Gln	Pro	Pro	Lys	Ile	Asn	Gly	Asn	Pro	Asn	Pro	2435	2440	2445	
Ile	Thr	Thr	Val	Arg	Glu	Ile	Ala	Ala	Gly	Gly	Ser	Arg	Lys	Leu	Ile	2450	2455	2460	
Asp	Cys	Lys	Ala	Glu	Gly	Ile	Pro	Thr	Pro	Arg	Val	Leu	Trp	Ala	Phe	2465	2470	2475	2480
Pro	Glu	Gly	Val	Val	Leu	Pro	Ala	Pro	Tyr	Tyr	Gly	Asn	Arg	Ile	Thr	2485	2490	2495	
Val	His	Gly	Asn	Gly	Ser	Leu	Asp	Ile	Arg	Ser	Leu	Arg	Lys	Ser	Asp	2500	2505	2510	
Ser	Val	Gln	Leu	Val	Cys	Met	Ala	Arg	Asn	Glu	Gly	Gly	Glu	Ala	Arg	2515	2520	2525	
Leu	Ile	Val	Gln	Leu	Thr	Val	Leu	Glu	Pro	Met	Glu	Lys	Pro	Ile	Phe	2530	2535	2540	
His	Asp	Pro	Ile	Ser	Glu	Lys	Ile	Thr	Ala	Met	Ala	Gly	His	Thr	Ile	2545	2550	2555	2560
Ser	Leu	Asn	Cys	Ser	Ala	Ala	Gly	Thr	Pro	Thr	Pro	Ser	Leu	Val	Trp	2565	2570	2575	
Val	Leu	Pro	Asn	Gly	Thr	Asp	Leu	Gln	Ser	Gly	Gln	Gln	Leu	Gln	Arg	2580	2585	2590	
Phe	Tyr	His	Lys	Ala	Asp	Gly	Met	Leu	His	Ile	Ser	Gly	Leu	Ser	Ser	2595	2600	2605	
Val	Asp	Ala	Gly	Ala	Tyr	Arg	Cys	Val	Ala	Arg	Asn	Ala	Ala	Gly	His	2610	2615	2620	
Thr	Glu	Arg	Leu	Val	Ser	Leu	Lys	Val	Gly	Leu	Lys	Pro	Glu	Ala	Asn	2625	2630	2635	2640
Lys	Gln	Tyr	His	Asn	Leu	Val	Ser	Ile	Ile	Asn	Gly	Glu	Thr	Leu	Lys	2645	2650	2655	
Leu	Pro	Cys	Thr	Pro	Pro	Gly	Ala	Gly	Gln	Gly	Arg	Phe	Ser	Trp	Thr	2660	2665	2670	
Leu	Pro	Asn	Gly	Met	His	Leu	Glu	Gly	Pro	Gln	Thr	Leu	Gly	Arg	Val	2675	2680	2685	
Ser	Leu	Leu	Asp	Asn	Gly	Thr	Leu	Thr	Val	Arg	Glu	Ala	Ser	Val	Phe	2690	2695	2700	
Asp	Arg	Gly	Thr	Tyr	Val	Cys	Arg	Met	Glu	Thr	Glu	Tyr	Gly	Pro	Ser				

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2705					2710					2715					2720
Val	Thr	Ser	Ile	Pro	Val	Ile	Val	Ile	Ala	Tyr	Pro	Pro	Arg	Ile	Thr
					2725				2730					2735	
Ser	Glu	Pro	Thr	Pro	Val	Ile	Tyr	Thr	Arg	Pro	Gly	Asn	Thr	Val	Lys
					2740				2745				2750		
Leu	Asn	Cys	Met	Ala	Met	Gly	Ile	Pro	Lys	Ala	Asp	Ile	Thr	Trp	Glu
					2755				2760				2765		
Leu	Pro	Asp	Lys	Ser	His	Leu	Lys	Ala	Gly	Val	Gln	Ala	Arg	Leu	Tyr
					2770				2775				2780		
Gly	Asn	Arg	Phe	Leu	His	Pro	Gln	Gly	Ser	Leu	Thr	Ile	Gln	His	Ala
2785					2790				2795						2800
Thr	Gln	Arg	Asp	Ala	Gly	Phe	Tyr	Lys	Cys	Met	Ala	Lys	Asn	Ile	Leu
					2805				2810					2815	
Gly	Ser	Asp	Ser	Lys	Thr	Thr	Tyr	Ile	His	Val	Phe				
					2820				2825						

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<210> 3
<211> 27
<212> DNA
<213> Artificial Sequence
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<220>  
<223> PCR primer

<400> 3  
ggagtcctgt ggcattccacg aaactac

27 '

```
<210> 4
<211> 25
<212> DNA
<213> Artificial Sequence
```

<220>  
<223> PCR primer

```
<400> 4
cacatctgct ggaagggtgga cagcg
```

25

```
<210> 5
<211> 26
<212> DNA
<213> Artificial Sequence
```

<220>  
<223> PCR primer

```
<400> 5
catgggcaca aactgactca tggctg
```

26

```
<210> 6
<211> 28
<212> DNA
<213> Artificial Sequence
```

<223> PCR primer

gagaggagag gaaggagaaa actgcatc

28

<211> 37

<212> DNA

<213> Artificial Sequence

<223> PCR primer

ttgcggccgc gccaccatgc ccaagcgcgc gcactgg

37

<211> 28

<212> DNA

<213> Artificial Sequence

<223> PCR primer

tcaatactcc tgctcctggt ctgtctca

28